COMPARATIVE STUDIES ON SEED COTTON YIELD IN RELATION TO NITROGEN RATE S AND SOWING DATES UNDER DIVERSE AGRO- ENVIRONMENT OF PUNJAB.

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ABSTRACT: The aim of present research work was to compare seed cotton yield of various cotton cultivars sown at different and nitrogen rates under variable environments of Punjab, Pakistan. For this purpose field experiments were carried out at Faisalabad, Sahiwal and Multan districts of Punjab during 2005 and 2006. Four cotton cultivars were sown at 3rd week of May and 2nd week of June and subject to four N levels (50,100,150 and 200 kg N ha^{-1}). The result indicate that sowing of cotton in 3rd week of may enhanced seed cotton yield by 29% over 2nd week of June and also increased different yield components and enhanced seed cotton. The treatment; 200 kg N ha^{-1} performed will and increased seed cotton by 29% over 50kg N ha^{-1}. Cultivar SLH-284 gave better results than other cultivars, Sahiwal location gave better yield followed by Multan and Faisalabad. It was concluded that selection of suitable cultivar, early sowing of cotton and proper N level could enhance cotton productivity under semiarid ad arid environments.

Key words: Seed Cotton, Cultivar, Environment, Nitrogen, Sowing date.

INTRODUCTION

Cotton (*Gossupium hirsutum L*.) is an important cash crop of Pakistan and it fetches a signification amount of foreign exchange ($ 14 millions). The contribution of cotton crop in the national economy is 6.9% of value addition and 1.4% of GDP (GOP, 2010). Besides engaging millions of population in employment, about 63% of country's edible oil requirement are met through its seed and the cake is palatable (GOP, 2010) is much lower than many cotton-producing counties of the world. There is need of advance planning and research to meet the fiber needs of ever burgeoning population @ 2.7% per anum (GOP, 2010).

Numerous studies have shown that early planting of cotton crop enhanced different yield components and seed cotton yield, increased growth and reduced flower and boll shedding overlate sown crop (Akhtar *et, al.*, 2002; Muhammad *et al*., 2002; Ali *et,al*., 2004; Arshed 2006) similarly research also showed that late planting deteriorates the quality of seed cotton. (Baur *et al*., 2000; Pettigrew, 2002). Different cultivars have their own genetic potential and they respond differently to various biotic and abiotic stresse as well as climatic conditions. Research work shows that different cultivars have different yield potential under varying environments. (Bange & Milroy.,2000; Ali *et al*., 2004; and Wajid *et al*., 2010).amongst nutrients, nitrogen is essential for plant growth and essential component of plant cells, proteins, chloroplasts and enzymes. Consequently nitrogen deficiency has a profound effect on yield and quality. Several workers have reported that increasing rates of nitrogen play a major role in increasing yield and quality of seed cotton (Wang-XueDe *et al*., 2004; Wiatrak *et al*., 2005 and Wajid *et al*., 2010). The objective of this research work was to evaluate the impact of sowing date, cultivar and nitrogen regimes on seed cotton yield and estimation of nitrogen use efficiency under varying environments of Punjab, Pakistan.

MATERIALS AND METHODS

Site and soil: Field experiments were carried out at Faisalabad (31° 26'N,73° 04'E, 172m) latitude, longitude and altitude, respectively, Sahiwal (31° 26'N,73° 06'E, 172m) and Multan (30°12'N,71°26'E.123m) districts of Punjab during 2005 and 2006. Soil was loam and typically deficient in organic matter, having pH 8.2 to 8.7. Faisalabad soil was more deficient in organic matter than other sites (Table-1). Composite soil samples to depth of 30 cm were obtained from each location with soil auger prior to sowing of crop. Soil samples were analyzed from Agriculture Chemist (soils) AARI, Faisalabad.

Weather of different sites during crop growth period: Stander weather date were record for each location using weather observatories installed at experimental sites by respective Government Department. the daily mean air temperature (°C), rainfall (mm), ad daily sunshine hours (h) were recorded (Table-2).

Table-1: Soil characteristics of experimental sites

Location	Climatic Zone	Soil Series	USDA Classification	Soil pH	OM (%)
Faisalabad	Dry- Semi-Arid	Lyallpur Loam	Fine, Loamy, Silty, therm	8.7	0.23
Sahiwal	Wet- Semi- Arid	Jaranwala Loam	Coarse, Silty, mixed, hyperthermic Calciargids	8.3	0.62
Multan	Dry- Arid	Kalamazoo Loam	Fine, Silty, Loam, mixed therm	8.2	0.73

Source: soil survey Department of Pakistan Lahore

Table 2: summary of the weather conditions during crop growth season at experimental sites.

Location	Mean air temperature (^oC)		Rainfall (mm)		Total sunshine hours (h)	
	2005	2006	2005	2006	2005	2006
Faisalabad	29.34	28.57	284	347	1588	1751
Sahiwal	30.56	31.26	162	418	1853	1870
Multan	29.49	30.12	227	64	1901	1748

Source: Observation post graduate agriculture research station (PARS) University of Agriculture, Faisalabad. Cotton Research station, Sahiwal and Central cotton Research Institute, Multan.

Design and treatment: All experience were laid out in split-split plot design with three replications. The net plot size was 3 m X 10m. two sowing dates were in main plots, while four cotton cultivars (CIM-496, CIM- 506, NIAB -111 and SLH-284) were randomized in sub plots and four nitrogen levels (50,100,150 and 200kg Nha^{-1}) were also randomized in sub-sub plots. Data collected on seed cotton yield and components was analyzed statistically using anova technique (Steel *et al.,* 1997) and significance of treatment means was tested using LSD 5% probability level. Pooled analysis was carried out within location across year/ seasons (Gomes & Gomes, 1984).

Crop husbandry: Crop was sown during 3rd week of may and 2nd week of June in both year using bed-furrow method with seed rate 25kg ha^{-1}, 75cm apart in rows, maintaining 30 cm plant-to-distance. Nitrogen was applied in the form of urea in two splits before 15th August in both seasons. All other agronomic practices like hoeing, irrigation, plant protection measures etc. were kept uniform for all the treatments.

Data collection: Five randomly selected plants from each experimental unit were tagged and measured for different yield components like number of sympodial branches plant $^{-1}$, number of mature boll plant-^{1} and seed cotton yield kg ha^{-1}. An area of 1.5m X 6m was picked and seed cotton yield was converted into kg ha^{-1} from each experimental unit.

RESULTS AND DISCUSSION

A summary of weather data for crop-growth period from May to November is presented in table (2). In both seasons the Sahiwal and Multan sites were relatively hotter than Faisalabad. Mean temperatures were higher by approximately 1-2^{o}C for Sahiwal and Multan then Faisalabad site. The pattern of increasing and decreasing average temperature was similar at all sites, increasing up to 33-34^{O}C from May to August and then decreased 25-27^{O}C towards maturity of crop. During both growing seasons Faisalabad and Sahiwal received 585 and 580 mm rainfall compared to Multan that received 291mm rainfall only.

Number of Sympodial branches $plant^{-1}$: Data (Table-3) show the effect of treatments on the number of sympodial (fruit bearing) branches $plant^{-1}$. Early showing significantly increased sympodial branches $plant^{-1}$ at Faisalabad by 11.76% (17 vs. 15). at Sahiwal 13.04% (23 vs. 20) and 10% (20 vs. 18) at Multan, respectively. Average over all locations, early sowing increased 10% (20 vs. 18) sympodial branched $plant^{-1}$ was also significant at all three sites. Maximum numbers of sympodial branch $plant^{-1}$ was also signification at all three sites. Maximum number of sympodial branches were produced were produced by cv. SLH-284 (21.25) followed by cv NIAB -111 (19.35), cv CIM -506 (18.43) and cv. CIM-496(18.2). Higher N fertilization 200 kg ha^{-1} significantly enhanced numbers of sympodial branches at all locations, the highest N produced 16.485 more (21.65 vs 18.08) sympodia than the lowest N rate50 kg ha^{-1}. The number if sympodia were 16.47, 21.35, 21.35, and 20.17 at Faisalabad, Sahiwal and Multan, respectively. The relationship of seed cotton yield and sympodia $plant^{-1}$was signification and R^2 ranged 49% to 70% at various location (Fig-1) there results corroborated the finding of Wiatrak *et, al.,* 2005 and Wajid *et,al*., 2010.

Number of mature/opened boll $plant^{-1}$: Data regarding opened bolls per plant (Table-3) showed that effect of season was signification at all sites all sites at maturity of bolls per plant. Averaged over all locations, number of matured bolls per plant was 26% more (16.16 vs. 12.00)

Table : 3. Effect of sowing date, cultivar and nitrogen level on yield and components planted under different environments.

Treatment	Sympodial branch plant^{-1}				Mature boll plant^{-1}				Seed cotton yield kg ha^{-1}			
	FSD	SWL	MLN	MEAN	FSD	SWL	MLN	MEAN	FSD	SWL	MLN	MEAN
Sowing date												
20th May	17 a	22.5a	20.8a	20.27	15a	17a	16a	16.16	1933a	2206a	1948a	2029
10th June	15b	20.2b	19.4b	18.36	9b	16b	11b	11.91	1040b	1719b	1579b	1446
LSD 5%	0.42	0.30	0.31	-	1.85	0.27	0.29	-	85.15	83.4	10.32	-
Cultivar												
CIM-496	16c	19.9c	18.4c	18.2	11c	16b	12d	13.02	1343c	1901c	1682c	1749
CIM-506	15.5c	21.bc	19.2c	18.43	11c	15c	13c	13.34	1473b	2014a	1759b	1768
NIAB-111	16.2b	2.15b	20.4b	19035	12b	17a	14b	14.33	1504b	1989a	1810a	1792
SLH-284	17.7a	23.3a	22.8a	21.25	14a	17a	16a	15.46	1626a	1945b	1804a	-
LSD 5%	0.31	1.08	1.01	-	0.43	0.37	0.41	-	33.4	34.10	15.20	1444
N Level												
50kg ha^{-1}	15.8c	19.8d	18.d	18.08	10d	15.c	11d	12.17	1748d	1513d	1637	0.90
100kg ha^{-1}	15.9c	20.7c	19.7c	18.78	11.c	15.c	10.c	12.77	1311c	1903c	1697c	1882
150kg ha^{-1}	16.6b	21.9b	20.7b	19.75	12.b	16.b	14.b	14.65	1623b	2028b	1851b	2035
200kg ha^{-1}	17.3a	23.0a	21.6a	20.64	14a	18a	18a	15.59	1941a	2170a	1994a	-
LSD 5%	0.32	0.90	0.91	-	0.24	0.19	0.22	-	23.49	21.58	16.95	-
Linear	**	**	**	-	**	**	**	-	**	**	**	-
Quadratic	NS	NS	*	-	**	**	**	-	**	**	**	-
Cubic	NS	NS	NS	-	NS	*	*	-	**	NS	NS	-
Year Effect	NS	NS	NS	-	**	**	**	-	**	NS	NS	-
A X B	**	**	**	-	**	**	NS	-	**	**	**	-
Mean	16.50	21.4	20.2		12	16.4	13.8	-	1487	1962	1764	-

Means sharing different letters significantly at 5% probabililty level.*= signification at 5% ,**=signification at 1% NS = non signification. FSD= Faisalabad, SWL= Sahiwal, MLN= Multan.

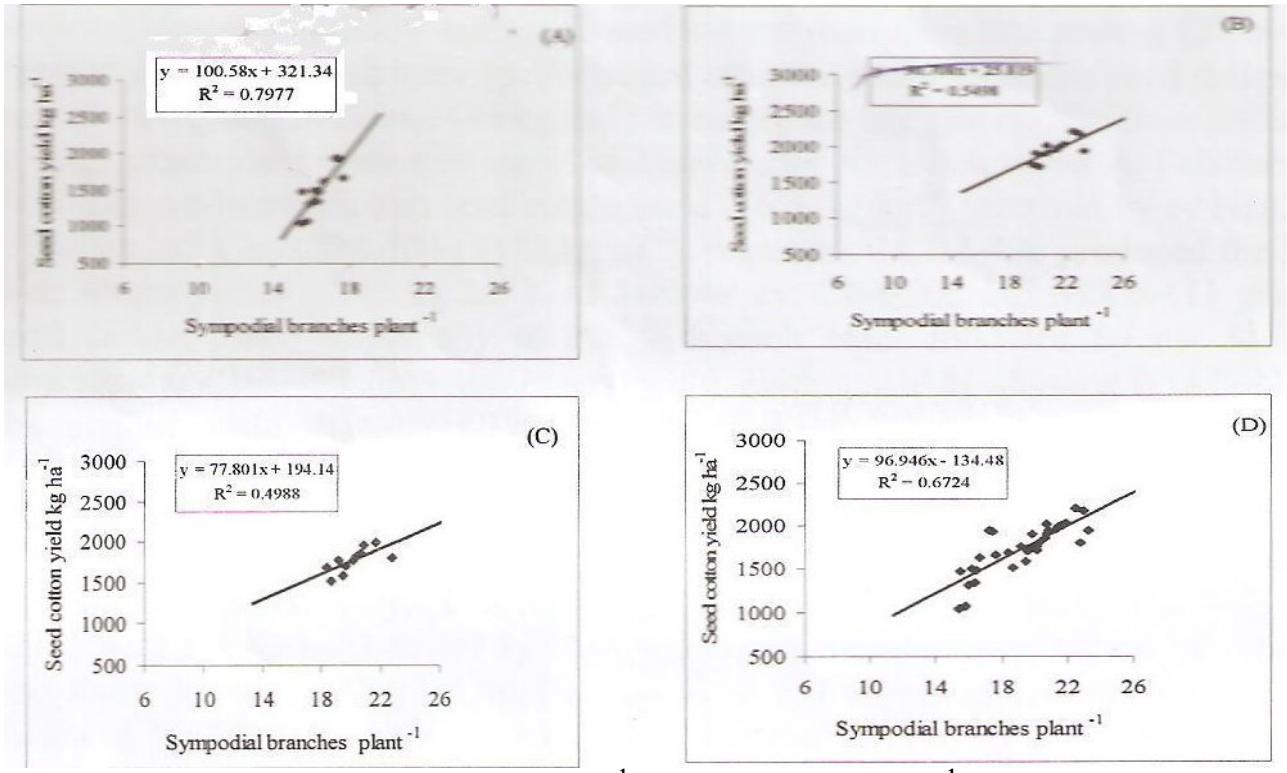

Fig 1: Relationship between sympodial branches plant^{-1} and seed cotton yield kg ha^{-1}
(A), at Faisalabad, (B) at Sahiwal, (C) at Multan and (D) pooled for all the locations.

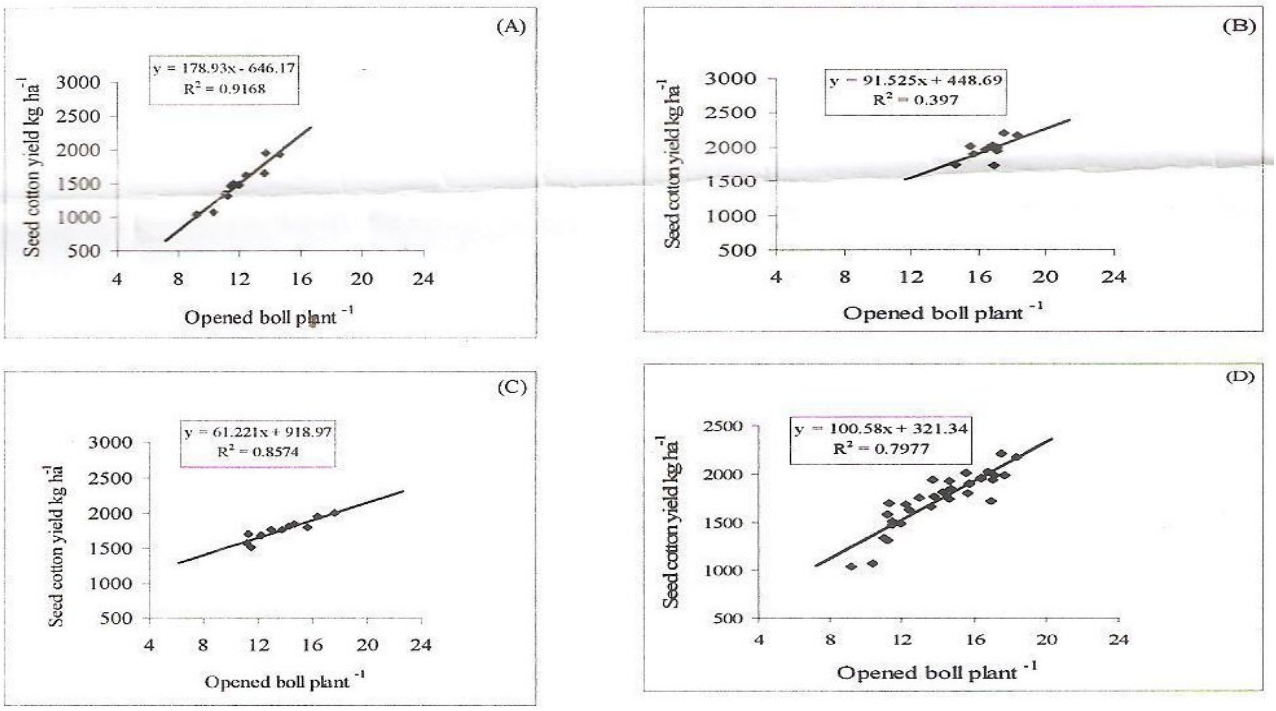

Figure 2. Relationship between opened boll plant-1 and seed cotton yield kg ha-1.
(A), at Faisalabad, (B) at Sahiwal, (C) at Multan and (D) pooled for all the locations.

in early sown crop compared with late sown crop. Number of matured bolls per plant was more in cv. SLH-284(15.46) followed by cv NIAB-111 (14.33), CIM-506 (13.34) and CIM-496 913.02). Similarly, signification higher number of matured bolls was present in the highest N level treatment than the lowest one, 21.43% increase (15.49 vs 12.17) was noted in higher N level than lower N level on the basis of average of all location. The response was quadratic (Faisalabad) or cubic (Multan and Sahiwal). The relationship between mature boll per plant was significant and the regression coefficient varied from 75% to 91%. (Fig-2).these findings are same as Bange & Milroy., 2000; Ali *et al*., 2004; and Wajid *et al*., 2010).

Seed cotton yield: Thable-3 present the effect of treatments on seed cotton yield. Early sowing in 3rd week of May significantly enhanced seed cotton yield than late sowing (2nd week of June) at all sites in both seasons. Averaged over the entire location seed cotton yield was 29% higher (2029 vs. 1446 kg ha^{-1}), in early than late sowing. Cultivar differences in seed cotton yield were also significant and varied for all location At Faisalabad cv. SLH-284 produced highest seed cotton yield (1626kg ha^{-1}) followed by cv. NIAB-111 (1504 kg ha^{-1}), cv. CIM-506(1473 kg ha^{-1}), whereas cv. CIM-506 and NIAB-111 produced the lowest seed cotton yields (1343 kg ha^{-1}). At Sahiwal cv. CIM-506 and NIAB-111 produced cotton seed produced seed cotton yield statistically at par with each other followed by cv. SLH-284, whereas cv. CIM-496 gave the lowest yield. Both cv. SLH-284 and NIAB-111 gave the highest yield than cv.CIM-506 and CIM-496 at Multan site (Table 3). Averaged over all the location the cv. SLH-284 enhanced seed cotton yield by 8.34 (1792 vs. 1642 kg ha^{-1}) than the cv. CIM-496. Differences in B levels significantly affected seed cotton yield at al location probably due to deficient organic matter and N contents in soils. Averaged over three location seed cotton yield was 29% higher (2035 vs. 1444kg ha^{-1}) at 200 kg N ha^{-1} compared with 50kg N ha^{-1} and the response was linear in nature. Overall seed cotton yield was higher at Sahiwal (1962 kg ha^{-1}) followed by Multan (1764 kg ha^{-1}) and Faisalabad (1487 kg ha^{-1}) Table-3. The results are in line with those of (Bange & Milroy., 2000; Ali et al., 2004).

Conclusion: The result showed that early sowing of cotton crop enhanced seed cotton (29%) yield and various components as well. The sowing time needs to be reinvestigated throughout the Punjab. Higher N application also increased productivity linearly linearly, the saturation point yet not achieved with the N level of 200 kg ha^{-1}. Optimum temperature and rainfall like in Sahiwal was helpful in investing seed cotton yield. Selection of suitable cultivar for each location is also helpful in sustaining yield. Yield differences among treatments were attributed to the number of sympodial

branches plant^{-1}, number of mature / opened bolls plant^{-1}. It was further observed

That year with high temperature (>30^{O}C) and lesser rainfall had significantly increased the yield of cotton under semiarid conditions. This type of research can be used to modify existing sowing time, cultivars and nitrogen fertilizer methods by including fertility status of soil, proper irrigation scheduling and mid season adjustments based on current climatic condition to increase the seed cotton yield.

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